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Revision: 0

SAVANNAH RIVER SITE

HIGH LEVEL WASTE SALT DISPOSITION
SYSTEMS ENGINEERING TEAM

APPLIED TECHNOLOGY INTEGRATION
SCOPE OF WORK MATRIX
FOR
ALPHA REMOVAL
(Demonstration Phase)

APPROVED:_____ DATE:_____
DOE HLW Assistant Manager

APPROVED:_____ DATE:_____
WSRC Program Manager

Change Control Record

Document Name	*Unique Identifier*
Science & Technology Work Scope Matrix for Alpha Removal (Demonstration Phase)	HLW-SDT-2000-00047

Summary of Changes

Revision Date	*Matrix Revision*	*BCF Number(s)*	*Reasons for change*	*Items Affected by the change*
February 15, 2000	0	NA	Initial Issue	NA

Use of Workscope Matrix

This Workscope Matrix has been developed to define the Science and Technology (S&T) development activities to be performed for Alpha Removal during the Demonstration Phase. The guiding documents for this Workscope Matrix are the HLW Salt Disposition SE Team Science and Technology Roadmaps for Small Tank TPB Precipitation, CST Non-Elutable Ion Exchange and Caustic Side Solvent Extraction. The S&T Roadmaps provide the technology development paths forward towards successful deployment of the three options. This matrix (Attachment 1) expands on the roadmaps by providing the high level details of each segment of Alpha Removal research and development, assigning responsibility for the execution of each segment and documenting the path through each segment of R&D in the form of a logic diagram (Attachment 2). The logic diagram ties to the S&T Roadmaps using S&T item numbers.

In this Demonstration phase, Scale-up will be performed wherever practical and advantageous to the confirmation of technology and application of technology to the full-size facility. The Workscope Matrix provides an additional definition of at which scale the S&T development is to be conducted.

ATTACHMENT 1 – Alpha Removal Work Scope Matrix

Item No.	Item	Considerations	Scale	Lead Org.	Path Forward Doc.	Reference Doc.	Uncertainty
Process Chemistry							
1.0	MST Adsorption Kinetics	*The addition of Monosodium Titanate (MST) has been proposed to adsorb the soluble U, Pu, and Sr contained in the waste stream. The rate and equilibrium loading of these components as a function of temperature, ionic strength and mixing is required to support the batch reactor design. Initial data from batch reactor data indicates the MST kinetics require more than the 24 hrs assumed in pre-conceptual design resulting in larger reactor batch volumes. Studies will be conducted to determine if the MST strike could be completed in the existing SRS waste tanks. Alternatives to MST will be investigated.* MST adsorption kinetics experiments have been performed at 7.5 M and 4.5 M Na+. As currently flowsheeted, the Alpha Sorption step for CST would be performed at 5.6 M Na+. Additional experimentation may be performed at 6.44 M Na+ for CSEX. Also, questions have been raised regarding the oxidation states of Pu (initial, as a function of ionic strength, and equilibrium as Pu is adsorbed onto MST) and the effect of oxidation states on MST adsorption rates. Since Pu is the primary source of alpha, it is important to assure that experimental results obtained with simulants are representative of performance with real wastes. 1.1 Repeat prior experiments on Sr, Pu, U, and Np removal with 0.2 and 0.4 g MST/L at 5.6M Na+ 1.2 Develop an understanding of the impact of Pu oxidation state on MST adsorption kinetics including which oxidation state(s) is adsorbed and the oxidation states present in both simulants and real waste (Work to be initiated in FY01) 1.3 Study Allied Signal NaT as a replacement for MST 1.4 Study alternative alpha removal technologies 1.4.1 Ferric flocculation – perform scoping studies 1.4.2 BNFL permanganate/calcium Sr/TRU flowsheet – perform scoping studies 1.4.3 Sodium uranate formation – study effect 1.4.4 Perform scoping test for any potential MST replacement(s) to screen for criticality issues	 Lab NA Lab Lab	 SRTC NA SRTC SRTC	HLW-SDT-TTR-99-30.0[1] WSRC-RP-99-01080[2] HLW-SDT-TTR-99-33.0[1] WSRC-RP-99-01080[2]	WSRC-TR-99-00134[3] WSRC-TR-99-00219[3] WSRC-TR-99-00286[3]	CST: 10, 11 TPB: 4 CSEX: 6
Process Engineering							
6.0	Engineering Scale Filtration Studies	*Filtration of MST and sludge is required to prevent plugging of the ion exchange column. Initial data indicates low flux rates for the filtration of these solutions requiring large filter areas and high axial velocity for cross flow filtration techniques. Alternative filtration techniques and filter aides will be studied, and a selection made. Filtration cleaning studies including the impact of spent cleaning solution will be studied.* Tests for MST/sludge filtration (Alpha Sorption step) performed during Phase IV (FY99)			HLW-SDT-TTR-99-30.0[1] WSRC-TR-99-00483[2]	WSRC-TR-99-00343[3]	CST: 9, 15 TPB: Design Input CSEX: 5

Note: See Matrix Legend for definition of column content

Item No.	Item	Considerations	Scale	Lead Org.	Path Forward Doc.	Reference Doc.	Uncertainty
		indicate low crossflow filter fluxes leading to very large filters. Improvement in filter size and operation is desired. 6.1 Elucidate role of TPB in filtration 6.2 Investigate/test ways to improve filtration rates/fluxes 6.2.1 Filter aids, flocs, etc 6.2.2 Different filtration technologies 6.2.3 Different filtration approaches; for example 6.2.3.1 Pre-filter/rough filter 6.2.3.2 Different ratios of flocs/aids, etc 6.3 Select most promising technology and run confirmation test with FRED at USC 6.4 Perform real waste tests using CUF (Work to be initiated in FY01)	 NA Lab Bench NA	 SRTC SRTC SRTC NA			
9.0	Analytical Sample Requirements	*The analytical sample requirements including on-line analysis must be developed to support control strategy development.* Develop an at line analyzer for Cs, Sr, and total alpha. Activities to resolve these issues are common to CST, TPB and CSEX	Full	PNNL/ Analytical Meas.Lab			CST: 5 TPB: 7 CSEX: 7

Note: See Matrix Legend for definition of column content

Matrix Legend

Item No.	Corresponds to the block number on the Science and Technology Roadmap and Logic Diagrams; provides a tie between documents.
Item	General title of the S&T block; corresponds to block title on the Science and Technology Roadmap and Logic Diagrams.
Considerations	Discusses the considerations pertinent to the completion and resolution of each item; provides details and numbered R&D activities to be performed to resolve the item (numbered R&D activities correspond to numbered activities on logic diagrams). Italicized text is extracted from previous roadmaps and reflects activities previously completed or no longer required.
Scale	Defines the scale at which R&D test will be performed (Lab scale, bench scale, engineering scale or pilot scale).
Lead Org.	Identifies the organization responsible for conducting the R&D activity and hence location where activity will be performed.
Path Forward Doc.	Lists the applicable Technical Task Requests (TTRs) denoted xxxx[1]; Task Technical and Quality Assurance Plans (TTPs) denoted xxxx[2] and Test Reports (TRs) denoted xxxx[3] which respectively initiate, plan and document the results of R&D activities.
Reference Doc.	Lists reference documents such as previous test results, reviews etc., which relate to the current R&D activity.
Uncertainty	Provides a cross-tie to the cost validation matrix uncertainty statement Ids within the Decision Phase Final Report, WSRC-RP-99-00007.
NA	Not Applicable

ATTACHMENT 2 – Alpha Removal S&T Logic Diagrams